DOCUMENT RESUME

ED 056 429 EC 040 375

AUTHOR Neville, Donald
TITLE The Development of an Instrument to Predict Modality Preference for Learning to Read.
INSTITUTION George Peabody Coll. for Teachers, Nashville, Tenn. Inst. on Mental Retardation and Intellectual Development.
PUB DATE 71
NOTE 41p.; IMRID Behavioral Science Monograph No 16

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS *Classification; *Elementary School Students; Program Development; *Reading; *Reading Tests; *Research Projects; Teaching Methods; Test Reliability; Test Validity
IDENTIFIERS Test of Modality Aptitude in Reading

ABSTRACT

Project objective was development of an experimental form of the Test of Modality Aptitude in Reading (TOMAR). The TOMAR was designed to classify children as visual, auditory, or kinesthetic learners in reading, to have sound measurement characteristics, and to be suitable for administration to groups of children rather than to an individual. Project development of a substitute alphabet and three word lists equated on meaningfulness and number of different letters was examined. Data pertaining to teaching method selection, reliability, validity, and profile analysis indicated that relationship between classification scheme and instructional procedure was not clear. Students taught to their strengths were found to gain more significantly than students taught to their weaknesses. Also, data indicated that students classified by a pure profile performed differently from those classified by a combination profile. The author concluded by posing questions relative to the probable directions of future investigations. (CB)

ED056429

IMRID

INSTITUTE ON MENTAL RETARDATION AND INTELLECTUAL DEVELOPMENT

A UNIT OF THE

John F. Kennedy Center for Research on Education and Human Development

GEORGE PEABODY COLLEGE FOR TEACHERS/NASHVILLE, TENNESSEE 37203

EC 040 375

IMRID Behavioral Science Monograph No. 16

THE DEVELOPMENT OF AN INSTRUMENT TO PREDICT MODALITY PREFERENCE FOR LEARNING TO READ

by

Donald Neville

1971

IMRID Behavioral Science Monograph No. 16

THE DEVELOPMENT OF AN INSTRUMENT TO PREDICT MODALITY PREFERENCE FOR LEARNING TO READ

by

Donald Neville

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

1971

IMRID Behavioral Science Monograph No. 16

THE DEVELOPMENT OF AN INSTRUMENT TO PREDICT MODALITY PREFERENCE FOR LEARNING TO READ[1]

by

Donald Neville

Institute on Mental Retardation and Intellectual Development
George Peabody College for Teachers
Nashville, Tennessee
1971

[1]An abbreviated form of this paper appeared in Ketcham, Clay A. (Ed.), Proceedings of College Reading Association. Vol. XI. Phillipsburg, N. J.: College Reading Association, 1970.

Abstract

This report describes the process by which an experimental form of the Test of Modality Aptitude in Reading (TOMAR) was developed. The objective of the project was to develop an instrument (a) which would classify children as visual, auditory, or kinesthetic learners, (b) which had sound measurement characteristics, and (c) which could be administered to groups of children rather than individually. The development of a substitute alphabet and three word lists equated on meaningfulness and number of different letters is discussed.

Data relative to the selection of teaching procedures, reliability, validity, and profile analysis are presented. The author concludes by reporting on a study relative to the effectiveness of the classification procedure and by posing questions regarding the probable directions of future investigations.

TABLE OF CONTENTS

	PAGE
ABSTRACT	iii
LIST OF TABLES	vii
LIST OF FIGURES	iv
I. INTRODUCTION	1
II. DEVELOPMENTAL PROCEDURES	5
Symbol System	5
Word Lists	5
Teaching Directions	9
Teaching Procedure	13
III. DESCRIPTION OF THE INSTRUMENT	17
Teaching Instructions	17
Reliability and Validity	17
Classification Procedure	19
A Study of Validity	21
IV. CONCLUDING STATEMENT	27
REFERENCES	29
APPENDIX	33

LIST OF TABLES

TABLE		PAGE
1	Meaning Difficulty of Word Lists by Modality	8
2	Number of Letters Taught by Day, Session, and Modality	11
3	Means and Standard Deviations (SD) of Modality Scores for Two- and Three-Step Teaching Procedures	14
4	Alpha Reliabilities for Two- and Three-Step Teaching Procedures	14
5	Correlations between Two- and Three-Step Teaching Procedures and Word Knowledge (WK) and Reading (R) Subtests of Metropolitan Achievement Test	15
6	Alpha Reliabilities for Two-Step Teaching Procedure, by Grades	18
7	Correlations between Modality Scores and Scores on Word Knowledge (WK) and Reading (R) Subtests of Metropolitan Achievement Test	19
8	Means and Standard Deviations (SD) for Each Modality and Grade	20
9	Standard Error of the Mean Difference of the T Scores for Each Pair of Subtests on the Test of Modality Aptitude in Reading (TOMAR)	21
10	Examples of Individual Scores on the Visual (V), Auditory (A), and Kinesthetic (K) Subtests and Classification Profiles	22
11	Profile Classification of Corrective Readers	23
12	Analysis of Variance of Pre- and Posttest Word Knowledge Scores (Expressed in Grade Equivalents) for the Five Patterns of the Test of Modality Aptitude in Reading (TOMAR)	24

LIST OF FIGURES

FIGURE		PAGE
1	Schedule for Administration of Mills Learning Methods Test.....	2
2	Substitute Alphabet.....	6
3	Plan for Administration of TOMAR.....	10
4	Learning Stimuli: Three-Step Teaching Procedure.....	12
5	Comparison of Pre- and Posttest Scores According to Classification Group and Teaching Strategy.....	25
6	Similar Patterns and Varied Levels of Functioning.....	28

CHAPTER I

INTRODUCTION

In general, there seem to be three sense modalities which have been used for the teaching of reading: visual, auditory (phonic), and kinesthetic. While it is true that the act of reading cannot be restricted to a single sense modality, methods which emphasize a particular sense modality are not uncommon.

The purpose of this project has been to develop an instrument which has the capacity to identify a child's strength and/or weakness in terms of sense modalities (visual, auditory, kinesthetic) as related to learning to read. An instrument with this capacity could provide valuable information relative to the selection of an instructional procedure which was matched to the learning characteristic of a particular child.

Interest in developing this instrument was aroused in several ways. Historically, several remedial techniques have stressed specific training in various sense modalities. Bateman (1967) attempted to classify several of these special methods. She notes Fernald's emphasis on the kinesthetic sense, Gillingham's assumption that specific visual, auditory, and kinesthetic senses must be trained, and other methods which are based on a similar notion regarding the need to stress the use of particular sense modalities. Thus, remedial experts have indicated a belief that methods which are organized to present reading material to specific sense modalities produce desirable results for remedial cases.

Much recent research has supported the historical notion of strengths and weaknesses among poor readers. For example, studies of the profiles of poor readers on the Wechsler Intelligence Scale for Children (WISC) have shown that poor readers exhibit relative weaknesses on certain auditory- and visual-memory tasks (Neville, 1966).

Because of the variations of modality efficiency among poor readers, many pioneers (e.g., Gates, 1945; Betts, 1957) interested in the treatment of reading and spelling difficulties have suggested that it would be diagnostically helpful if one could predict which sense modalities would exhibit strengths and weaknesses in the instructional process. In fact, Gates included a measure of this type in his Diagnostic Reading Test. Robert E. Mills (1955)

developed an instrument (see Figure 1), which was purported to make sense modality distinctions related to reading. However, it had to be administered individually, and in Mills' opinion, did not meet the standards of a fully developed measurement instrument.

I. First Day

A. Identify 40 words unknown to child
B. Randomly assign words to four lists
C. Teach 10 words visually
D. Test over words taught (immediate recall)

II. Second Day

A. Test words taught first day (delayed recall)
B. Teach 10 words auditorially
C. Test auditory words (immediate recall)

III. Third Day

A. Test words taught second day (delayed recall)
B. Teach 10 words kinesthetically
C. Test kinesthetic words (immediate recall)

IV. Fourth Day

A. Test kinesthetic words (delayed recall)
B. Teach 10 words combined method
C. Test combined words (immediate recall)

V. Fifth Day

A. Test combined words (delayed recall)

Figure 1. Schedule for administration of Mills Learning Methods Test.

The purpose of much of the recent research has been to identify that method of teaching initial reading which is most efficient. However, when these studies are examined, the findings usually indicate that, regardless of method, about one-third or one-fourth of the children profited only minimally. Mills (1965) also concluded that no one method was best for all children.

These data led to the hypothesis that perhaps it would be more logical to attempt to match child and method on pertinent variables rather than search for a "best method." A first step toward the matching would be an instrument which would classify the reading learning patterns of children. It could be that a substantial portion of the group which does not learn to read by a given method is weak in the modality initially stressed by that method. For example, if a method stresses visual clues, perhaps it is those children who show weakness in the visual modality who do not learn effectively. Chall (1967) reached a similar conclusion: "Obviously every method produces ranges of attainment and every method has its failures. And it may well be that certain individuals find one method or another method particularly suitable or impossible [p. 139]." Thus, the available evidence suggested that the development of an instrument which could predict modality efficiency would be of great assistance in planning instructional programs in reading.

The specific objectives were to develop an instrument which: (a) was technically sound (e.g., had adequate reliability and validity); (b) could be administered to groups so that it had a potential for classroom use; (c) could identify learning patterns and predict instructional strengths and weaknesses; and (d) had teaching procedures which could be directly adapted to the instructional situation.

CHAPTER II

DEVELOPMENTAL PROCEDURES

Symbol System

The problem of devising a task which could be administered to a group of children proved troublesome. The earlier tests devised by Gates and Mills had relied on identifying words which were not known by a given child and then teaching the words to him through prescribed procedures, an operation which was not applicable to groups. It was finally decided that the best way to solve the problem of group administration was to devise a new symbol or alphabet. In this way all children being tested could be assumed to be naive readers and thus be taught the same words.

In devising the new symbol system, it seemed important that it conform to certain characteristics of our traditional alphabet so that inferences could be made from how a child learned with the new alphabet to reading performances with the traditional orthography. Therefore, certain characteristics of the traditional orthography were maintained in the new one. It can be noted from Figure 2 that:

1. There are 26 letters in each system and traditional spelling is maintained (e.g., dog = ⊦ < ⫪).

2. The same number of ascending and decending consonants appear on each alphabet.

3. The reversal and/or rotational relationships and other similarities between letters are maintained (e.g., m = ∇ ; w = Δ).

Word Lists

After having developed the symbol system, the next step was to select the words to be taught. First the pool of words from which the word lists were to be developed was chosen. Those words included in the pool met the following criteria:

1. In order to be certain they were most likely to be meaningful to children, all words in the pool were selected from the Dale List of 769 Easy Words (Hunnicutt & Iverson, 1958).

Figure 2. Substitute alphabet.

2. Because pictures were to be used in the instructional portion of the test, the words selected had to be picturable.

3. Only words containing three to six letters were selected.

This procedure resulted in the selection of 66 words which met the above criteria.

Next the words were tested in order to estimate whether or not young children could learn to associate the stimulus word in its verbal form with the picture which had been devised to accompany it. This procedure tested the meaningfulness of the word in the situation in which it was to be used. Specifically, 100 first-graders and 108 second-graders, three classrooms of each, were shown different sets of 22 pictures on each of three consecutive days and were told the word which was associated with each picture. Next the examiner asked one of the children in the class to respond to each of the pictures. The children were then given material containing each of the pictures and asked to mark the correct picture when the examiner said the word. From this procedure, each word was given a meaning index which reflected the total number of times it had been missed.

Three word lists of 16 words each were then constituted and equated as far as possible on the meaning index (see Table 1). An analysis of variance indicated that the three word lists were not significantly different ($p < .20$). One word list was assigned randomly to each of the three modality teaching procedures.

Initially, it was thought that it would be possible to use the Mills procedure of teaching the list visually one day, auditorially the next, and kinesthetically on the third day. However, as more thought was given to this idea, it became clear that this procedure would not be a sound one. The potential additive effect of presenting the new alphabet on three consecutive days could not be ignored. It was, therefore, decided to teach words in each modality each day and to vary the order of the modality presentation each day. After all sessions were administered, the total number of words learned through each modality resulted in a Visual, Auditory, and Kinesthetic score for each subject. These scores could then be compared so that strengths and weaknesses could be identified.

Table 1

Meaning Difficulty of Word Lists by Modality

Visual		Auditory		Kinesthetic	
Word	Missed	Word	Missed	Word	Missed
Bed	4	Egg	0	Leg	1
Lock	2	High	2	Bath	2
Pen	2	Funny	3	Duck	1
Chick	1	Animal	1	Stand	4
Family	2	Dinner	0	Smoke	1
Farmer	1	Sit	3	Dog	1
Day	3	Bug	2	Fire	3
Pond	1	Time	0	Truck	3
Plant	2	Yard	2	Window	0
Afraid	0	Light	5	Pocket	2
Arm	2	Hello	4	Nut	2
Game	1	Sister	2	Man	1
Barn	1	Cat	0	Hill	2
World	0	Tree	0	Drink	2
Teeth	0	Slide	0	Cookie	0
Circus	2	Garden	1	Basket	2
Mean	1.50		1.56		1.69
SD	1.06		1.54		1.04

The three word lists were divided so that they could be taught in six sessions, two each day, with eight words per session (see Figure 3). This was necessitated by the time factor. It took about 40 minutes to complete each administration. Care was taken so that words with meaning connections (e.g., arm--leg, dog--cat, or chick--egg) and words which had picture similarities (e.g., farmer and man) were not taught in the same session. Also, no two words with the same configuration were taught in the same modality in the same session.

Another crucial variable in which the sessions and modalities needed to be equated was number of different letters presented. McCutcheon and McDowell (1969) had found that the number of different letters presented in a learning session greatly affected the difficulty of the word list. Therefore, an attempt was made to equate the number of different letters and the number of total letters presented in each of the sessions. Table 2 shows that the results of this attempt were satisfactory.

Teaching Directions

The next step was to develop appropriate teaching and testing procedures for each modality. In order to accomplish this, a two- and three-step procedure for each modality was devised. The major difference between the two- and three-step methods was the amount of instructional time involved, rather than any qualitative difference in instruction.

For the three-step procedure, each word was presented three separate times. The first time the word was presented with only the correct picture available as a response. The second time the presentation occurred with one distractor picture present, and the third time with the three distractors (see Figure 4). Steps 1 and 2 were accomplished with the entire word list before continuing to step 3. The total time involved in these three presentations and the accompanying instructional directions was about 3 minutes per word. Since eight words were presented per session, this meant that approximately 24 minutes were spent on instructional procedures. When general directions, practice words, testing, and the completing of the cover sheets were added to this, the total time used for the administration of eight words was about 47 minutes.

The two-step procedure utilized the last two steps described above, thus reducing the teaching time by about 8 minutes.

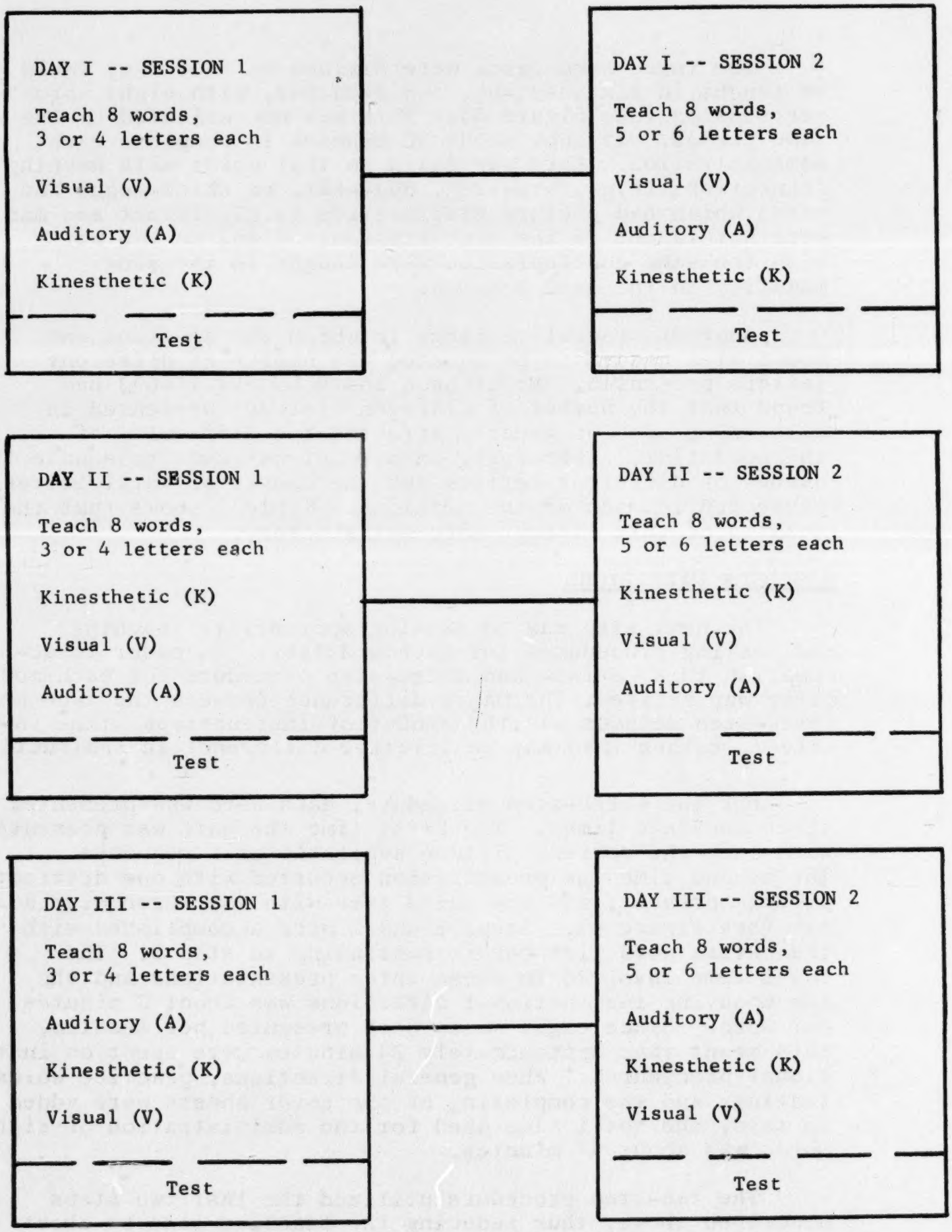


Figure 3. Plan for administration of TOMAR.

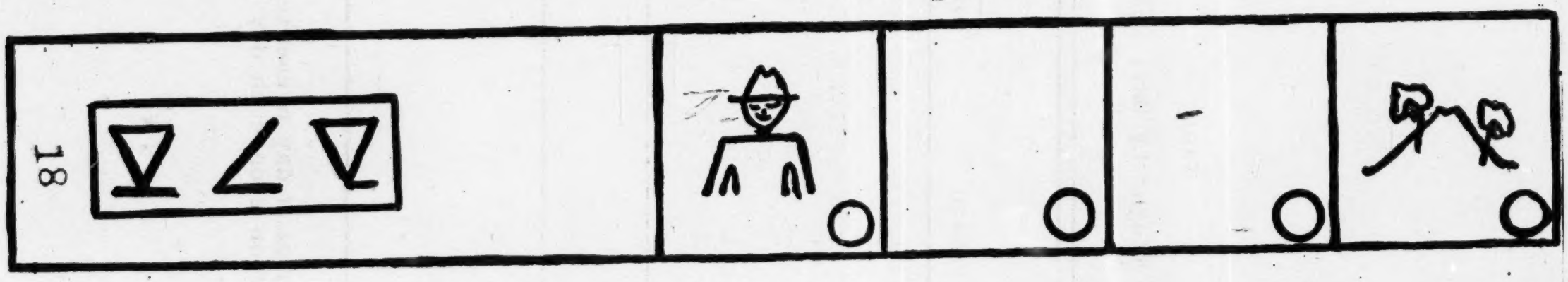
Table 2

Number of Letters Taught by Day, Session, and Modality

Day	Session [a]	Letters Taught	
		Total	Different
First	1	28	24
	2	44	31
Second	1	28	24
	2	44	30
Third	1	28	22
	2	44	33

Modality	Different Letters
Visual	21
Auditory	18
Kinesthetic	20

[a] Session 1 on each day presented three- and four-letter words; Session 2 on each day presented five- and six-letter words.



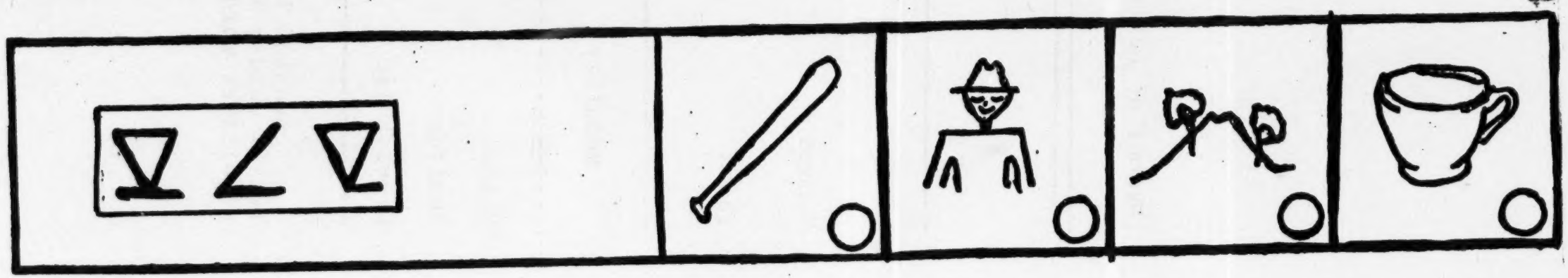


Figure 4. Learning stimuli: Three-step teaching procedure.

When the two- and three-step methods were compared empirically, the following results were observed:

1. An analysis of variance indicated that there was indeed a significant difference ($F = 5.82$, 1/220 df, $p < .05$) in the number of words learned. The three-step group learned significantly more words than did the two-step group (see Table 3).

2. A comparison of alpha reliabilities indicated that there was very little difference between the two- and three-step procedures (see Table 4).

3. A comparison of the correlations between the modality test scores for the two- and three-step procedures and scores on the Metropolitan Achievement Test again exhibited small differences (see Table 5).

From the foregoing data, it appeared that little was gained by using the three-step instructional procedure. In fact, it appeared that it had two disadvantages. A perusal of Table 3 shows that the ceiling of the test with the three-step procedure was in doubt. For example, the auditory mean using the three-step procedure was 24.16 with a standard deviation of 8.33. Since a score of 32 was perfect, scores varied less than one standard deviation above the mean. With the two-step procedure, scores varied almost two standard deviations above each modality mean. Also, the fact that the two-step procedure took considerably less time was in its favor. Thus, the two-step procedure was selected because it was shorter, possessed reliability and validity not different from the three-step method, and resulted in a test having a more acceptable ceiling.

Testing Procedure

Immediately following the presentation of 8 words with the procedure just described, a 16-item test was administered. The test was, in reality, two combined 8-item tests (see Figure 3). The examiner led the subjects through each word in the test, instructing them to use modality identification tactics which were appropriate to the initial teaching of the word. Correct responses were randomized, except in the case of initial position. Since it had been found that a preponderance of guesses were placed in the first position by children this age, the correct response occurred in the initial position only once in any given session.

Table 3

Means and Standard Deviations (SD) of Modality Scores for Two- and Three-Step Teaching Procedures

Modality	Three-Step		Two-Step	
	Mean	SD	Mean	SD
Visual	21.91	7.69	17.51	7.30
Auditory	24.16	8.33	18.19	7.73
Kinesthetic	19.61	8.05	16.25	6.95
Total Test	65.68	22.64	51.96	20.58

Table 4

Alpha Reliabilities for Two- and Three-Step Teaching Procedures

Modality	Three-Step	Two-Step
Visual	.89	.90
Auditory	.91	.90
Kinesthetic	.89	.87

Table 5

Correlations between Two- and Three-Step Teaching Procedures and Word Knowledge (WK) and Reading (R) Subtests of Metropolitan Achievement Test

Modality	Three-Step		Two-Step	
	WK	R	WK	R
Visual	.53	.56	.49	.50
Auditory	.55	.53	.54	.56
Kinesthetic	.53	.55	.51	.55
Total Test	.57	.58	.55	.57

CHAPTER III

DESCRIPTION OF THE INSTRUMENT

Teaching Instructions

The two-step teaching procedure described previously was the one selected. Children were tested in groups of 14 to 17. One presentation contained the word in the new orthography accompanied by two pictures, one of which was the correct response. The second presentation differed in that the word was accompanied by four pictures, one of which was a correct match. The presentation of each word was carefully timed.

The general procedure was to present each of the words taught in one session under the two-choice condition, and then again under the four-choice condition. In order to more fully understand the procedure, the reader is referred to Figures A through F (see Appendix). In these figures, the picture at the top of the page represents the student's booklet, and an outline of the content directions read by the instructor is given below. In the test manual, specific directions including time allotments are given for each word (Neville, 1970).

Examiners received at least 8 hours of training before administering tests to subjects. The training consisted of observations of the test being administered and practice administrations under observation. Particular attention was given to time spent on each word and pronunciation of auditory words. Timing was accomplished by use of a stop watch.

Reliability and Validity

In order to assess the reliability of the instrument, it was administered to 60 third-graders, 30 fourth-graders, and 30 fifth-graders. The subjects were randomly selected from the total third-, fourth-, and fifth-grade populations of two elementary schools in Nashville, Tennessee. Experience with earlier forms of the test had indicated that reliabilities for third-graders might be low. Therefore, the data for third-graders were examined separately from those for fourth- and fifth-graders. Table 6 shows the alpha reliabilities which indicated that, in all instances, the reliability for the third-graders was somewhat lower than that for the combined fourth- and fifth-graders.

Table 6

Alpha Reliabilities for Two-Step Teaching Procedure, by Grades

Modality	Grades 3-4-5		Grade 3		Grades 4-5	
	α	N	α	N	α	N
Visual	.90	120	.88	60	.91	60
Auditory	.90	120	.89	60	.92	60
Kinesthetic	.87	120	.85	60	.88	60

However, the differences were not substantial and could be partially explained in terms of less guessing by older children resulting in higher interitem correlations, which increased the alpha reliability.

The validity of the test was examined in two ways. First, a concurrent procedure estimated the correlations between scores on the Test of Modality Aptitude in Reading (TOMAR) and scores on the Word Knowledge (WK) and Reading (R) subtests of the Metropolitan Achievement Test. Table 7 shows the results of this computation. While these correlation coefficients are not high, they indicate that a marked relationship exists.

The validity of the TOMAR is also indicated by the consistency of its differentiation of third- and fourth/fifth-graders. When analyses of variance comparisons were made, grade was always a factor for which significant differences occurred. Table 8 shows a summary of means and standard deviations by grades. For each subtest and for the total score, fourth- and fifth-graders had mean scores which were significantly higher than third-graders.

An additional fact which must be noted is the difference between modality scores. It can be seen in Table 8 that the directions of the differences were consistent. Auditory scores were highest, followed in order by Visual and Kinesthetic

scores for the total group, for the third-grade group, and for the fourth/fifth-grade group. A mixed analysis of variance was conducted with Grade Level as the between-groups factor and Subtests as the within-groups factor. To maintain proportionality, the fourth and fifth grades were collapsed. With only one degree of freedom, Grade Level failed to attain significance, but an F of 10.8485 was obtained for Subtests, which is significant at the .0001 level. The difference between Visual and Auditory was significant (t = -.6780) at the .05 level, the difference between Visual and Kinesthetic was significant at the .01 level (t = 1.2610) and the difference between Auditory and Kinesthetic was also significant at the .01 level (t = 1.939).

Table 7

Correlations between Modality Scores and Scores on Word Knowledge (WK) and Reading (R) Subtests of Metropolitan Achievement Test

Modality	WK	R
Visual	.49	.50
Auditory	.54	.56
Kinesthetic	.51	.55
Total Test	.55	.57

Classification Procedure

Due to differences in means and standard deviations the data were transformed to normalized T scores prior to profile analysis. Next each subject's individual profile was analyzed so that individual strengths and/or weaknesses could be determined. Two simple procedures were available. The first consisted of a comparison of each subtest score with the total score, a second alternative was to compare each subtest score with the mean of the other two subtests. The latter procedure was chosen because the former involved a linear dependency while the latter did not.

Table 8

Means and Standard Deviations (SD) for Each Modality and Grade

Modality	Grades 3-4-5		Grade 3		Grades 4-5	
	Mean	SD	Mean	SD	Mean	SD
Visual	17.51	7.30	16.52	7.17	18.58	7.79
Auditory	18.19	7.73	17.12	7.24	19.20	8.06
Kinesthetic	16.25	6.95	15.30	6.54	17.12	7.27
Total Test	51.96	20.58	48.93	18.98	54.90	22.23
N	120		60		60	

In order to give statistical support to the classification scheme, a system establishing levels of significance for differences was needed. This was accomplished by treating the data as though there were six subtests; namely, Visual, Auditory, Kinesthetic, Visual-Auditory, Visual-Kinesthetic, and Auditory-Kinesthetic. After computing reliabilities and standard deviations for each of these "subtests," a standard error of measurement was found for each.

Since each word was tested twice, correlations between first and second presentations were computed. It was this reliability which was used in computation of the standard errors of measurement for the Visual, Auditory, and Kinesthetic comparison. For the Visual-Auditory, Visual-Kinesthetic, and Auditory-Kinesthetic subtests similar procedures were used (Davis, 1964).

This made it possible to compute a standard error of difference for each appropriate pair, and then a profile of strengths and/or weaknesses could be established. Table 9 lists the standard errors used for each comparison. The results were rounded off to simplify the computations for classification.

Table 9

Standard Error of the Mean Difference of the T Scores for Each Pair of Subtests on the Test of Modality Aptitude in Reading (TOMAR)

TOMAR subtest pairs	SE_D
Visual and Auditory-Kinesthetic	7.89 [a]
Auditory and Visual-Kinesthetic	8.17
Kinesthetic and Auditory-Visual	8.18

[a] For ease of computation, the standard errors were rounded to 8.00.

Table 10 gives an example of the scores of students and an indication of the strengths and weaknesses classified. Theoretically, it would have been possible to have 12 profile types. Six of these would be "pure" and would consist of a single strength or weakness in any one of the three modalities. The other six profiles would be combinations of strengths and weaknesses among the three modalities. For example, in Table 10, Subject A has a "pure" visual strength, Subject B a "pure" kinesthetic weakness, and Subject C a "pure" auditory strength. Subjects D and E would be examples of combination strengths and weaknesses, since they show both a strength and a weakness.

A Study of Validity

The classification procedure was then applied to a group of 157 inner-city third-graders who had been referred to a corrective reading program, and who, according to scores on the Metropolitan Achievement Test, were achieving at least one year below the expected level for third grade. The classification procedure yielded 77 subjects, 44 male and 33 female. Also, 44 were identified as having combination-type patterns and 33 as having a

Table 10

Examples of Individual Scores on the Visual (V), Auditory (A), and Kinesthetic (K) Subtests and Classification Profiles

Subjects	T Scores			Strengths and Weaknesses [a]		
	V	A	K	V	A	K
A	56	48	47	+		
B	42	40	32			-
C	36	49	38		+	
D	50	44	39	+		-
E	40	32	46		-	+

[a] Strength is indicated by a plus (+); weakness by a minus (-).

"pure" strength or weakness. Table 11 shows the sex and classification patterns of this group.

These subjects were assigned to one of three instructional groups based on their classification pattern. Three schools participated in the program, and at each school, there was a visual class in which the visual aspects of the word were stressed. These classes were made up of students having visual strengths, visual weaknesses, or randomly assigned no-pattern students utilized for comparison purposes and to bring all class sizes to 15. Each school also had an auditory class, stressing the sound cues in reading, and a kinesthetic class in which tracing was used as an attentional device. Three teachers participated, one to a school; each teacher taught one visual, auditory, and kinesthetic class. After the subjects had been assigned, all were given the Word Knowledge (WK) subtest of the Metropolitan Achievement Test, Elementary Form B, as a pre-intervention measure. This subtest was used because word recognition skills were emphasized in all classes.

Table 11

Profile Classification of Corrective Readers

Classification		Sex	
Strength	Weakness	Male	Female
Visual	None	0	3
Auditory	None	3	3
Kinesthetic	None	2	2
None	Visual	2	3
None	Auditory	4	4
None	Kinesthetic	2	5
Visual	Auditory	5	4
Visual	Kinesthetic	4	2
Auditory	Visual	3	0
Auditory	Kinesthetic	8	1
Kinesthetic	Visual	3	3
Kinesthetic	Auditory	8	3

Because of a limited sample size, it was impossible to analyze by Visual, Auditory, and Kinesthetic groups. Instead, these three groups were collapsed and the gains of five groups were compared: pure strength; pure weakness; combination strength; combination weakness; no-pattern.

A preliminary one-way analysis of variance indicated that the five groups did not differ significantly on pre-test scores ($F = 2.30$, 4/70 df, $p > .05$). At the end of the instructional period, Form C of the Metropolitan Achievement Test was given as a posttest. The data were analyzed through the use of a Lindquist (1953) Type I analysis of variance, with Groups as the between factor and Pre- and Post-test scores as the within factor.

It can be observed in Table 12 that the initial analysis of variance indicated an overall significant difference related to the main effects of pre- and posttest Scores ($F = 37.19$, 1/70 df, $p < .01$) and to the interaction

Table 12

Analysis of Variance of Pre- and Posttest Word Knowledge Scores (Expressed in Grade Equivalents) for the Five Patterns of the Test of Modality Aptitude in Reading (TOMAR)

Source	Degrees of freedom	Mean square	F
Between	74	0.59	
Groups (G)	4	0.98	1.74
Error between	70	0.56	
Within	75	0.25	
Scores (S)	1	5.88	37.19*
G X S	4	0.53	3.34*
Error within	70	0.16	
Total	149	0.42	

*$p < .01$.

etween Groups and Scores. The Groups X Scores interaction was investigated with t tests. This analysis indicated that there were significant pre- and posttest differences for the groups taught according to their strengths ($t = 3.56$,. 9 df, $p > .05$) and for the no-pattern groups ($t = 6.95$, 21 df, $p > .05$), but not for those groups taught according to weaknesses. These differences, pictured in Figure 5, enhance the validity of the TOMAR, since they indicate that those subjects assigned to instructional procedures which coincided with their strengths made significantly more progress than those assigned to procedures coinciding with their weaknesses. Logically, the no-pattern group would progress equally well under any of the three procedures.

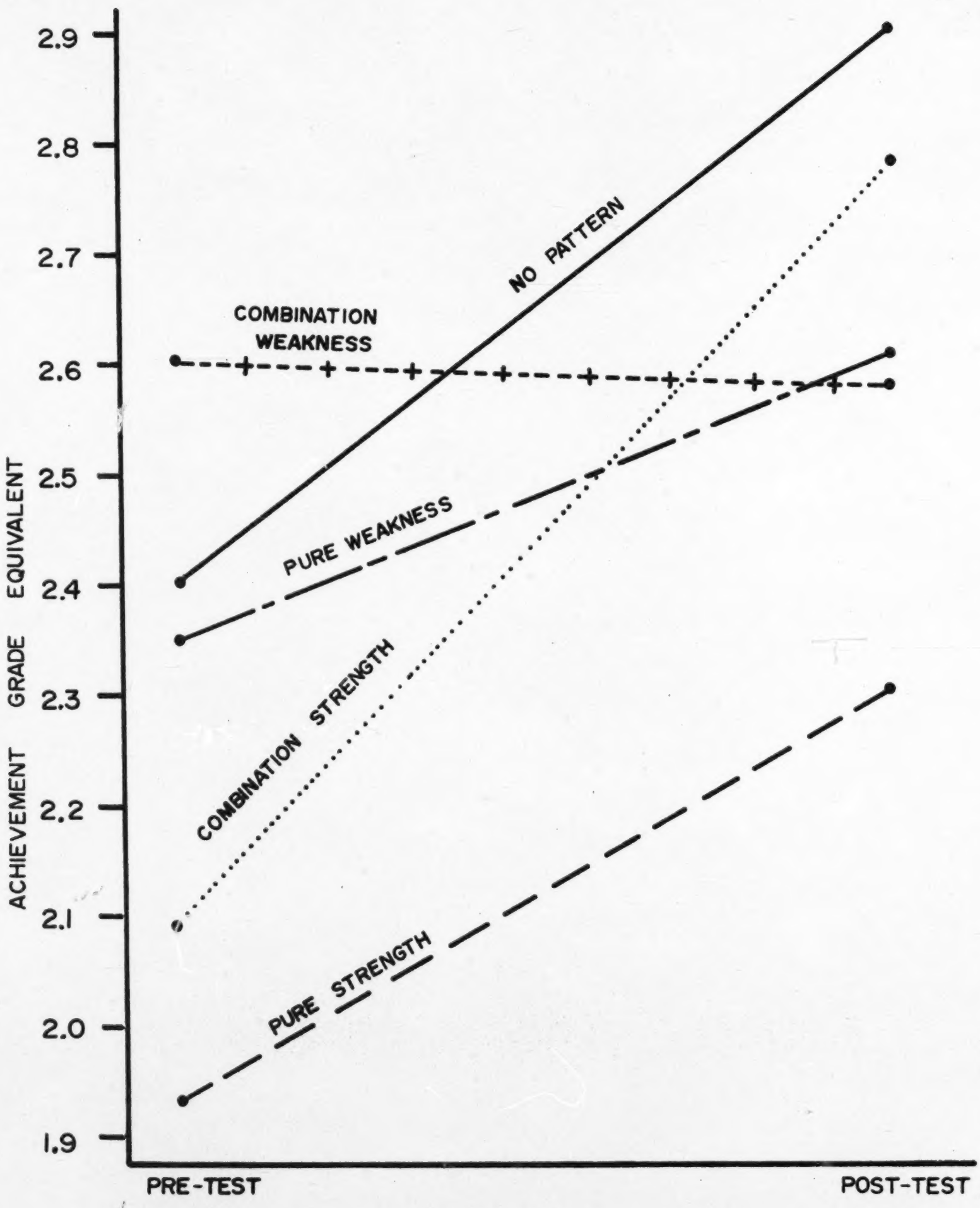


Figure 5. Comparison of pre- and posttest scores according to classification group and teaching strategy.

CHAPTER IV

CONCLUDING STATEMENT

The relationship between the classification scheme and the instructional procedure is not yet clear. While those students taught to their strengths made significantly more gain than those taught to their weaknesses, it also appears that the subjects classified as having a "pure profile" performed differently from those classified as having a "combination profile." More research is needed to adequately investigate the relationship between these two classifications.

Research related to the combination profiles promises to be difficult. For example, when one begins to evaluate a procedure for two subjects, one with a visual-strength/auditory-weakness pattern and the other with a visual-strength/kinesthetic weakness pattern, the comparisons are complicated. When one is taught visually and shows a visual strength, can auditory and kinesthetic weaknesses be considered to be of equal advantage or disadvantage?

Another question of importance is related to the level at which a youngster performs. Two students may be classified in the same category but have different overall levels of functioning. Figure 6 illustrates this problem. Categorically, Subjects X and Y have visual strengths which are equal in relation to their other scores. However, Student X is functioning in a very superior way. In fact, it seems quite possible that, for Student X, the effect on learning to read of the variance in modality may be relatively unimportant, while for Subject Y, it may be crucial.

As can be seen, the research with this instrument is in its initial stages. There are doubtless many problems not anticipated which may indicate that this method of attacking the problem is not fruitful. However, it appears that, unless some match between method and pupil can be accomplished, reading problems are likely to be with us in increasing numbers.

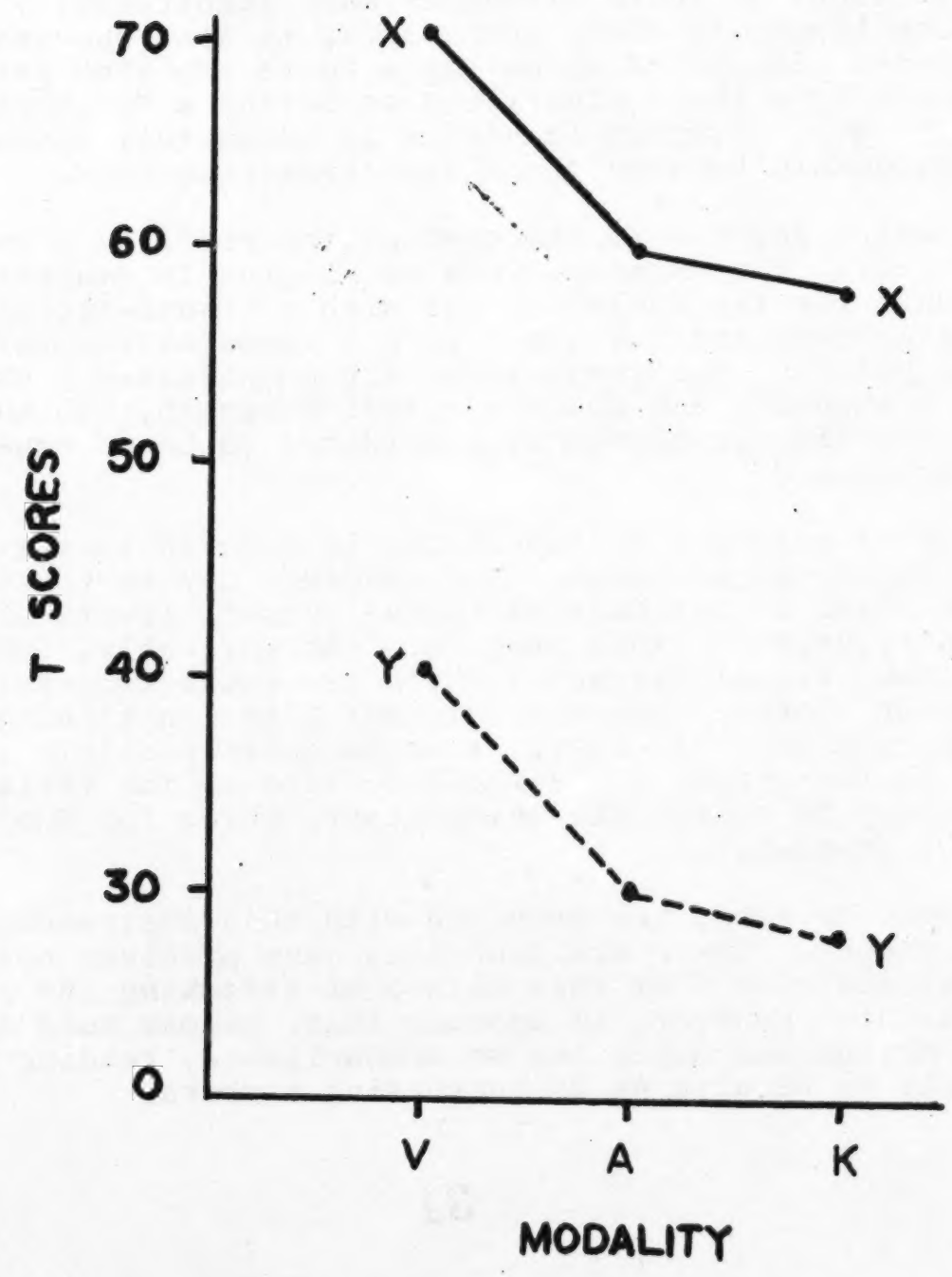


Figure 6. Similar patterns and varied levels of functioning.

REFERENCES

REFERENCES

Bateman, B. Learning disabilities - yesterday, today, and tomorrow. In E. C. Frierson & W. B. Barbe (Eds.), Educating children with learning disabilities: Selected readings. New York: Appleton-Century-Crofts, 1967.

Betts, E. A. Foundations of reading instruction. (Rev. ed.) New York: American Book, 1957.

Chall, J. Learning to read: The great debate. New York: McGraw-Hill, 1967.

Davis, F. B. Educational measurements and their interpretation. Belmont, Calif.: Wadsworth Publishing, 1964.

Gates, A. I. Gates diagnostic reading test. (Rev. ed.) New York: Teachers College Bureau of Publications, 1945.

Hunnicutt, C. W., & Iverson, W. J. Research in the three r's. New York: Harper Brothers, 1958.

Lindquist, E. F. Design and analysis of experiments in psychology and education. Boston: Houghton Mifflin, 1953.

McCutcheon, B. A., & McDowell, E. A. Intralist similarity and acquisition and generalization of word recognition. Reading Teacher, 1969, 23, 103-107.

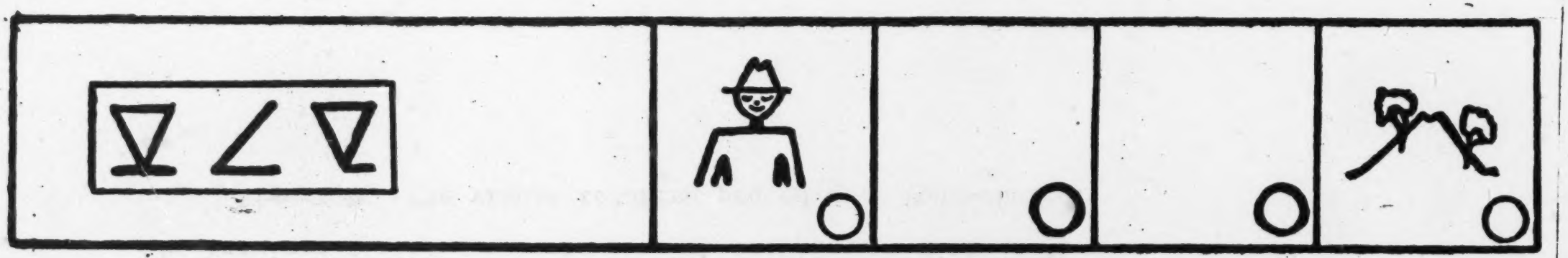
Mills, R. E. Learning methods test. Fort Lauderdale, Fla.: Mills Center, Inc., 1955.

Mills, R. E. An evaluation of techniques for teaching word recognition. In W. B. Barbe (Ed.), Teaching reading: Selected materials. New York: Oxford University Press, 1965.

Neville, D. D. Learning characteristics of poor readers as revealed by the results of individually administered intelligence tests. In Vistas in reading: Proceedings of International Reading Association, 1966, 2(1), 554-559.

Neville, D. D. The test of modality aptitude in reading (TOMAR). Unpublished test, Institute on Mental Retardation and Intellectual Development (IMRID), George Peabody College for Teachers, Nashville, Tennessee, 1970.

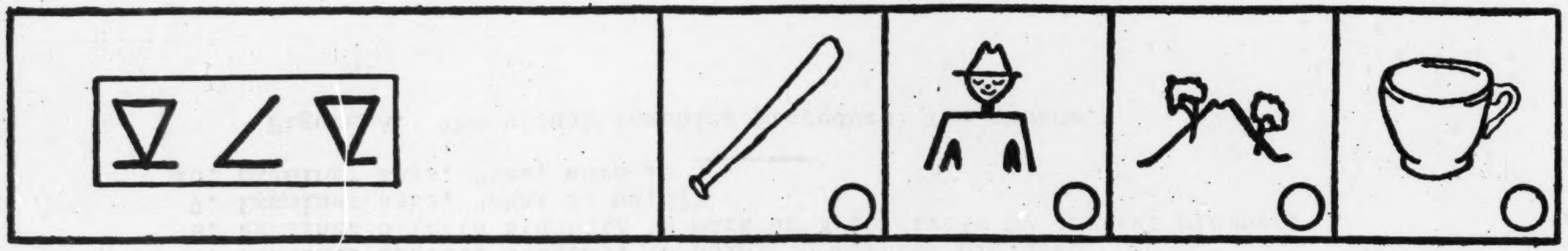
APPENDIX



Instructions

1. Examiner says, "The word is _____." Examiner asks students to point to the word.
2. Examiner discusses the length of word (number of letters).
3. Examiner notes ascending and descending letters.
4. Examiner notes shape of word; double or like letters.
5. Examiner asks students to cover their eyes.
6. Examiner directs students to compare shape they saw with one outlined on sheet.
7. Examiner directs students to point to correct picture.
8. Examiner directs students to mark an X in circle by correct picture.
9. Examiner asks, "What is word?"
10. Examiner says, "Yes, word is _____."

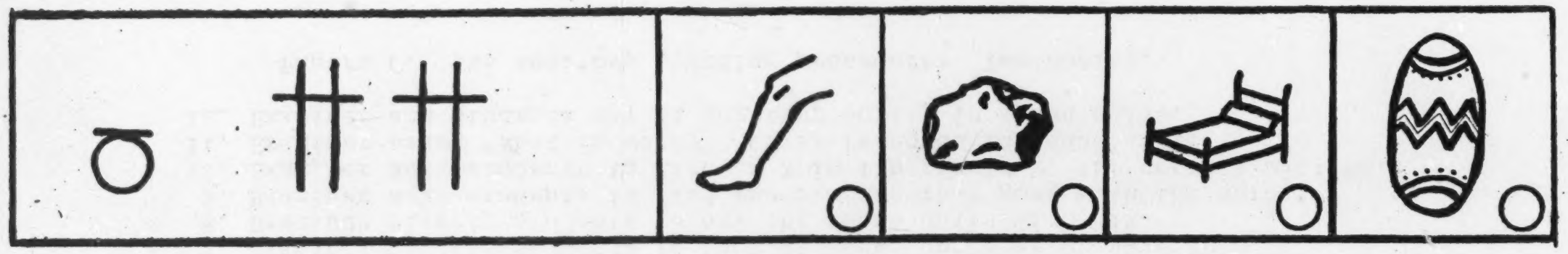
Figure A. The visual teaching procedure: Two-choice.



Instructions

1. Examiner asks students to point to word.
2. Examiner notes outline or shape of word.
3. Examiner notes length (number of letters) of word.
4. Examiner points to ascending and descending letters.
5. Examiner asks students to look at shape (outline).
6. Examiner directs students to look at pictures and point to the correct one.
7. Examiner asks, "Did you select the _____ picture?"
8. Examiner states, "The word is _____."
9. Examiner directs students to mark the picture with an X.

Figure B. The visual teaching procedure: Four-choice.

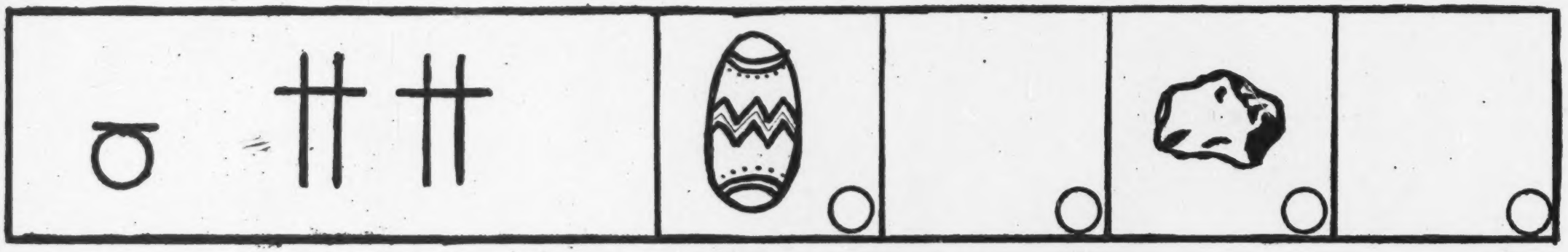


Instructions

1. Examiner points to word.
2. Examiner says the word in sound units.
3. Examiner asks, "How many sound units are there?"
4. Examiner directs students to say the sound units to themselves.
5. Examiner directs students to point to the correct picture.
6. Examiner asks, "Did you choose the _____ picture?"
7. Examiner asks students to say the word in sound units. Children respond.
8. Examiner directs students to mark an X in the circle by the correct picture.

Figure D. The auditory teaching procedure: Four-choice.

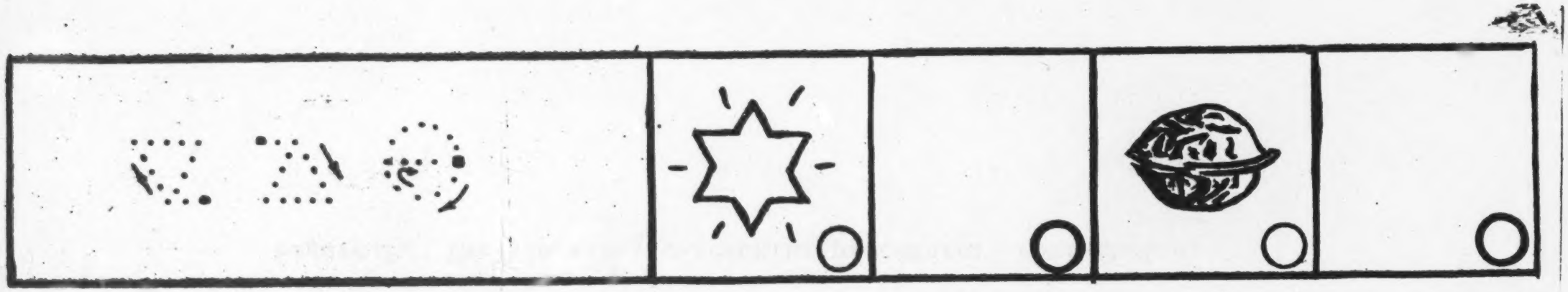
38



Instructions

1. Examiner says, "The word is [in sound units]." Examiner points to word.
2. Examiner says, "It has _____ sound units."
3. Examiner directs students to point to the word.
4. Examiner directs students to point to sound units.
5. Examiner asks, "How many sound units are there?"
6. Examiner notes larger space between sound units.
7. Examiner directs students to look at sound units as he says them.
8. Examiner directs students to say the sound units with him.
9. Examiner asks students to find the picture that goes with the word.
10. Examiner asks students to mark an X in the circle by the correct picture.
11. Examiner asks, "What is word?" Class responds in sound units.
12. Examiner and students say it together softly in sound units.

Figure C. The auditory teaching procedure: Two-choice.



Instructions

1. Examiner says, "The word is _____."
2. Examiner points to the word.
3. Examiner directs students to trace the word, always beginning a letter at the box, and starting a new line if there is an X.
4. Examiner directs students to begin at the first letter to trace the word _____.
5. Examiner directs students to say the word softly as they trace it.
6. Examiner asks, "What is the word?"
7. Examiner repeats, "Yes it is _____."
8. Examiner asks students to find correct picture and mark it with an X.
9. Examiner asks again, "What is word?"
10. Examiner repeats, "Yes, it is _____."

Figure E. The kinesthetic teaching procedure: Two-choice.

Instructions

1. Examiner asks students to point to word _____.
2. Examiner directs students to trace dotted lines.
3. Examiner asks, "Do you know word?"
4. Examiner directs students to point to the correct picture.
5. Examiner asks, "Did you choose the _____ picture?"
6. Examiner repeats, "The word is _____."
7. Examiner directs students to mark the correct picture with an X.

Figure F. The kinesthetic teaching procedure: Four-choice.